CLAIMS

1. A method for forming an oxide film on a metal surface, the method comprising anodization in the presence of an ionic liquid.

2. The method for forming an oxide film on a metal surface according to claim 1, wherein a defect of an oxide film previously formed on a metal surface is repaired by the anodization in the presence of an ionic liquid.

3. The method for forming an oxide film on a metal surface by anodization according to claim 1 or 2, wherein the metal is at least one selected from aluminum and/or alloys thereof, tantalum and/or alloys thereof, and niobium and/or alloys thereof.

4. The method for forming an oxide film on a metal surface according to claims 1 to 3, wherein an anion component of the ionic liquid is an atomic group containing fluorine.

5. The method for forming an oxide film on a metal surface according to claims 1 to 3, wherein an anion compound of the ionic liquid is an atomic group containing a sulfonic acid anion ($-SO_3^-$).

6. The method for forming an oxide film on a metal surface by anodization according to claims 1 to 3, wherein an anion component of the ionic liquid is an atomic group

containing a carboxylate anion ($-COO^-$).

7. The method for forming an oxide film on a metal surface according to claims 1 to 6, wherein a cation component of the ionic liquid is at least one selected from imidazolium derivatives, ammonium derivatives, and pyridinium derivatives.

8. The method for forming an oxide film on a metal surface by anodization according to claims 1 to 7, wherein a solution containing an ionic liquid and at least one selected from ammonium salts, amine salts, quaternary ammonium salts, tertiary amines, and organic acids is used.

9. An electrolytic capacitor comprising means for the method according to claims 1 to 8 for repairing an oxide film.

10. An electrolytic capacitor comprising a solution containing at least one ionic liquid and used as an electrolyte serving as means for repairing an oxide film.

11. The electrolytic capacitor according to claim 10, wherein the solution further contains a conductive polymer.

12. The electrolytic capacitor according to claim 11, wherein the conductive polymer is at least one selected from polypyrrole, polyaniline, polythiophene, and derivatives thereof.

13. The electrolytic capacitor according to claim 11 or 12, wherein the weight ratio (ionic liquid/conductive

polymer) of the ionic liquid to the conductive polymer is in a range of 1/10,000 to less than 1/10.

14. The electrolytic capacitor according claims 10 to 13, wherein the solution further contains a TCNQ salt.

15. The electrolytic capacitor according to claim 14, wherein the TCNQ salt is a salt containing a donor composed of a nitrogen-containing heterocyclic compound substituted by an alkyl at the N position and an acceptor composed of TCNQ.

16. The electrolytic capacitor according to claims 10 to 15, wherein an anion component of the ionic liquid is an atomic group containing at least fluorine.

17. The electrolytic capacitor according to claims 10 to 15, wherein an anion component of the ionic liquid is an atomic group containing at least a sulfonic acid anion ($-SO_3^-$).

18. The electrolytic capacitor according to claims 10 to 15, wherein an anion component of the ionic liquid is an atomic group containing at least a carboxylate anion ($-COO^-$).

19. The electrolytic capacitor according to claims 14 to 18, wherein the weight ratio (ionic liquid/TCNQ salt) of the ionic liquid to the TCNQ salt is in a range of 1/10,000 to less than 1/2.

20. The electrolytic capacitor according to claims 10 to 19, wherein a cation component of the ionic liquid is an

imidazolium derivative, an ammonium derivative, or a pyridinium derivative.

21. An electrolyte comprising a solution containing the ionic liquid according to claims 1 to 8, wherein the electrolyte is used for forming an oxide film on a metal surface by anodization.

22. An electrolyte comprising a solution containing the ionic liquid according to claims 9 to 22, wherein the electrolyte is used for an electrolytic capacitor.